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Incorporation of Carica papaya L. Leaves Flour in the Diet of Chicks at Gbadolite City and its Effects on Zootechnical Parameters

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ABSTRACT

The goal of present study, carried out at Gbadolite city, was to incorporate the papaya leaves flour into the food diet of chicks from 0 to 8 weeks and to evaluate its effects on some zootechnical parameters. We used one day-80 non sexed chicks from the artisanal incubator. Those chicks have been divided in two groups: the first group with 40 chicks fed with the diet incorporating papaya leaves flour (*Carica papaya* L.) (L_1) and the second group with 40 others chicks fed with the diet lacking the aforementioned flour and served as control (L_0). The obtained results indicated that papaya leaves flour based diet was more provided (1337.5 g) than the control diet (1025 g); The test diet (L_1) had brought about fewer cases of mortality (10%) than the control diet (L_0) (17%); The diet enriched with the *Carica papaya* L. flour is quite better according to its consumption index (1.4 versus 1.6 for control diet); The test diet (L1) has favored more medium live weight (156.7 g) and average live weight gain (33.8 g) than the control diet (L_0) with 87.9 g and 23.5 g respectively. The results obtained seem to be comparable to those obtained with other foods. For this purpose, it is encouraging to feed chicks using the diet seasoned with papaya leaves as source of antibiotics, proteins, vitamins and anti-helminthes because the imported balanced diet is expensive and has been the stumbling block of development projects in developing countries.

Keyword: Chicks, Diet, Carica papaya L., Gbadolite, Nord-Ubangi, Democratic Republic of the Congo.

INTRODUCTION

Undernourishment and malnutrition never cease to be an important issue in Tropical countries where they generate the deficiency-related diseases such as kwashiorkor and marasmus. Vulnerable people such as pregnant and lactating women, infants, preschool children and poor elderly people are the most affected [1, 2].

The Democratic Republic of Congo is not spared at all of this problem despite its enormous potential that it abounds as the long hydrographic system, vast and rich in fish, more than 80 million ha of arable lands and sub-soils qualified as geological scandal [3]. Despite this wealth, different studies show an important of malnourished cases, either 46% of children under the age of five years show lagging growth and suffer from chronic malnutrition, and 80% of Congolese population lives under the threshold of poverty and 70% is under nourished [4]. A latest investigation showed that six of 11 provinces of DRC are stricken by global acute malnutrition with 13% of cases in the “Equateur” province [5].

The major cause of these diseases is the food deficiency in proteins especially that of animal origin. That deficiency could be filled in by meat consumption and other foods rich in proteins. To cope with this problem, many African governments and some population have maintained the breeding and farming development, species with a short life cycle such as poultry in the frame of providing animal products of high nutritive value to the population and this, at a low cost. Yet, despite all the efforts made for the livestock development, but this sector still depends on inputs of imported feeds for poultry. These products are expensive for African countries and lead further to the competition of the food between man and animal. In order to reduce these importations and this competition for foods, the recourse to other non-conventional feed resources as feeds for poultry, and this would allow making profitable this practice in tropical regions [6].

Several scientific studies have shown that the use of plants in cattle diet has a lot of positive effects on the growth and production of animals [7-11].

The goal of the present study was to incorporate *Carica papaya* L. leaves in chicks feeding, and to evaluate its effects on the live weight and weight gain. The significance of this study is obvious because it would allow the use of locally available biological resources as source of primary and secondary metabolites necessary for the growth and development of poultry.

MATERIALS AND METHODS

STUDY AREA

The study was conducted at Gbadolite, at the "50 villas/Pangoma, Plateau des Professeurs" of the Gbadolite University. This site is located at 4°17' N and at 2°2' E with an altitude of 500 m above sea.

BIOLOGICAL MATERIAL

The biological material consisted of 80 local chicks race divided in two lots according to the kind of food. The first lot had 40 chicks fed with a test diet (L_1) enriched in *C. papaya* leaves and the second lot had as well 40 chicks fed with the control diet (L_0).

DESCRIPTION OF THE INCUBATOR USED

An artisanal incubator of 7 cm long, 46 cm large and of a capacity of containing hundred eggs was used. This incubator used the rapid combustion of palm oil as a source of heat. A cage of 120 x 80 x 50 cm was used to allow the good growth of chicks during all the period of the experiment. The mangers and the drinking trough were made of bamboo.

FIXING UP OF THE HOUSING AND EQUIPMENT OF CHICKS

The chicks have been farmed in self stabilizing within the cage of120x 80x50cm and of the due cage was added dried litter of *Psapalum notatum* of 3 cm thick.

Besides the two mangers made with bamboo, two drinking trough of 200 ml equipped with half empty milk cans of 400 g and two Chinese lanterns were lighted and placed almost side by side in the East or West facades.

PREPARATION OF EXPERIMENTAL DIETS

CHOICE OF INGREDIENTS

Besides *Zea mays* L. (Maize) and *Glycine max* L. (soybean), we used local ingredients particularly quasi mature papaya leaves (*Carica papaya* L.), oxen bones, snail shells, fish and NaCl.

PROCESSING OF INGREDIENTS

Before mixing our different ingredients, each of them has undergone some prior treatments. The maize grains were purchased, winnowed, sorted out, washed with water, dried out under the sun on a thin layer on a bag of 70 x 125 cm for 4 days and at last was ground in order to obtain the granular flour. Soybeans were purchased from a local market, winnowed, sorted out, dried out for 4 days, roasted, and at last ground for obtaining the flour, which was more or less granular;

Fish: purchased, winnowed, sorted, washed with plenty of water, dried out under the sun on a thin layer of a plastic bag for 4 days and ground to get finely flour. Papaya leaves were picked, washed with plenty of water, dried out under the sun for 4-5 days on a thin layer of a plastic bag, pounded and sieved in order to get a finely ground flour. The snail shells were collected, washed with plenty of water, dried out under the sun, on a thin layer of a plastic bag, incinerated to have ash, and pounded, then sieved in order to get a finely ground flour. NaCl was purchased, crushed and sieved.

FEEDING AND DRINKING OF FARMING CHICKS

During the lagging phase, the feed was presented into crumbs and then in granules (3.5 to 5 mm).In order to avert waste and indigestion of chicks, the diets were given thrice daily whereas water was administered at *ad libitum* [12]. The water renewal was done at least twice a day. The two lots were separated and fed with the diets aforementioned respectively.

HYGIENE AND PROPHYLAXIS

The more rigorous observance of hygienic measure was adopted in the habitat to prevent incidence and severity of diseases. For this purpose, all the materials were previously washed with soap and rinsed with water, dried out under the sun and put upon the large bag in order to protect them from eventual contamination. The bedding was changed twice a week for not stressing the chicks. Health prophylaxis was focused on early detection of sick chicks, their isolation and incineration in case of death.

OBSERVATIONS

For this study, the following zootechnical parameters were selected: body weight, weight gain, consumption, consumption index and mortality. These parameters were collected weekly.

DESIGNING A RATIONING TABLE USING LOCAL INGREDIENTS

For the present study, the method of trial and error and it takes into account nutritive value of ingredients.

RESULTS

The tables 1 and 2 show the nutritive value of the diet enriched and non-enriched in *Caricapapaya* L. leaves flour.

Table 1: Nutritive Value of diet incorporating papaya leaves flour (Carica papaya L.)

N°	Simple feeds	Q (Kg)	BP (%)	Ca (g)	P Tot (g)	P ass (g)	Lipids (Kg)	Sugar (Kg)	Met & Cys (g)	Cellulose (Kg)	NaCl	Lys (g)	E.M. (Cal)	EP (70%)
1	Corn flour	4,809	0,45	1	15	6,5	0,2	3,55	21	0,13	-	0,13	1675	1173
2	Cassava flour	2	0,17	0,6	6	2,6	0,01	1,6	1	0,08	-	2,2	620	434
3	Fish flour	1,8	1,2	76	45	27	0,13	0,08	46,3	0,02	-	96	5656	3959
4	Soybeans flour	1	0,43	2,45	-	-	0,22	0,29	12,2	0,05	-	27,5	4230	2961
5	Papaya leaves flour	0,2	0,04	1,5	0,4	0,12	0,02	0,07	2	0,02	-	1,4	380	266
6	Bone flour	0,08	-	26,72	12,96	-	-	-	-	-	-	-	-	-
7	Shells	0,1	-	35,6	-	-	-	-	-	-	-	-	-	-
8	NaCl	0,005	-	-	-	-	-	-	-	-	0,005	-	-	-
9	Gravel	0,005	-	-	-	-	-	-	-	-	-	-	-	-
10	C.A.V	0,001	-	-	-	-	-	-	-	-	-	-	-	-
11	Total	10	2,29	143,87	79,39	36,22	0,58	-	82,5	0,3	0,05	127,23	12561	8793
12	%	-	22,9	1,44	0,79	0,36	5,8		0,83	3	0,5	1,3	-	-
13	Standard %	-	20-27	1-1,2	0,6-0,8	0,45-0,6	8,8-10	-	0,8	≤5-8	0,5	1,1-2	3364	2355
14	Deficit	-	-	-	-	0,08	3	-	-	-	-	-	-	-
15	Excess	-	-	0,24	-	-	-	-	-	-	-	-	9104	6439

Legend: Q : quantity, BP: brute protein, Ca: calcium, PTot: total phosphorus, Pass: assimilable phosphorus, Met & Cys: methionine & cysteine, Lys: lysine, EP: potential energy

Table 2: Nutritive Value of unincorporated papaya leaves flour (Carica papaya L.) diet

N°	Simple feed	Q (Kg)	BP (%)	Ca (g)	P Tot (g)	P ass (g)	Lipids (Kg)	Sugar (Kg)	Met & Cys (g)	Cellulose (Kg)	NaCl	Lys (g)	E.M (Cal)	EP (70%)
1	Corn flour	4,91	0,47	1,4	15,6	6,76	0,21	3,69	21,84	0,13	-	0,13	1742	1219,4
2	Cassava flour	2	0,17	0,6	6	2,6	0,01	1,6	1	0,08	-	2,2	620	434
3	Fish flour	1,8	1,2	76	45	27	0,13	0,08	46,3	0,02	-	96	5656	3959
4	Soybeans flour	1	0,43	2,45	-	-	0,22	0,29	12,2	0,05	-	27,5	4230	2961
5	Bone flour	0,08	-	26,72	12,96	-	-	-	-	-	-	-	-	-
6	Shells	0,1	-	35,6	-	-	-	-	-	-	-	-	-	-
7	NaCl	0,05	-	-	-	-	-	-	-	-	0,05	-	-	-
8	Gravel	0,05	-	-	-	-	-	-	-	-	-	-	-	-
9	C.A.V	0,01	-	-	-	-	-	-	-	-	-	-	-	-
10	Total	10	2,27	142,77	79,56	36,36	0,57	-	81,34	0,3	0,05	127,23	12248	8573,4
11	%	-	22,7	1,43	0,8	0,36	5,7		0,81	3	0,5	1,3	-	-
12	Standard(%)	-	20-27	1-1,2	0,6-0,8	0,45-0,6	8,8-10	-	0,8	≤5-8	0,5	1,1-2	3364	2355
13	Deficit	-	-	-	-	0,08	3	-	-	-	-	-	-	-
14	Excess	-	-	0,23	-	-	-	-	-	-	-	-	9104	6439

Legend: Q : quantity, BP: brute protein, Ca: calcium, P_{Tot}: total phosphorus, P_{ass}: assimilable phosphorus, Met & Cys: methionine & cysteine, Lys: lysine, EP : potential energy

It can deduced from tables 1 and 2 that diets enriched and/or unenriched with C. papaya L. leaves flour has a deficit in absorbed phosphorus and in lipids. This deficit was filled by addition ad libitum of meal bones and crude palm oil. By cons, excess in calcium, EM and EP have been noted in both tables. However, the BP content, Ptot, Met and Cys, cellulose, NaCl and Lys were within the range of the recommended standards [1, 13-15]. The presence of C. papaya L. leaves slightly improves the nutritive value of the chicks' diet especially in terms of brute protein content.
The table 3 gives the evolution of body chicks' body weight and live weight.

Table 3: Weekly evolution of body weight and live weight gain

Period (Weeks)	Lots									
	L_0 (Control)					L_1 (Test)				
	PVT (g)	PVM (g)	GPVT (g)	GPVM (g)	Mty	PVT (g)	PVM (g)	GPVT (g)	GPVM (g)	Mty
00	1769	24,9	-	-	-	3912	30	-	-	-
01	1886	36,3	858	11,4	2	4118	45	600	15,0	-
02	1898	39,1	664	2,8	5	4208	63,8	625	18,8	2
03	1911	45,4	898	21,2	3	4318,8	86,8	700	23,0	2
04	3084	55	908	34,6	2	4352,08	105,7	575	18,9	1
05	3729	86,8	1040	28,6	2	4467,48	151,5	1300	45,8	2
06	3984	118	783	17,2	-	4482,88	187,5	620	36,0	3
07	4504	138,4	1207	44,4	2	4497,48	283,3	1380	95,8	-
08	5357	159,9	1103	27,6	1	4512,48	300	2000	16,7	-
Mean	3128,1	78,2	932,6	23,5	2,4	4318,8	139,28	975	33,8	2,0

Legend: L_0: Chick of control lot intaken with feed lacking papaya leaves flour., L_1: Chick of test lot intaken with feed enriched with papaya leaves flour, PVT: Total Live Weight of the lot, PVM: Average Live Weight of the lot, GPVT: Live Weight Gain of the lot, GPVM: Average Live Weight Gain of the lot, Mty : Mortality rate of Chicks in the lot, g: gram.
It can deduce from this table that the incorporation of *C. papaya* L. in the diet of chicks increased PVT, PVM, GPVT and GPVM. And also it decreases the mortality rate of chicks.
The table 4 shows the live weight gain and consumption index of chicks in the control and test group.

Table 4: Results of feeding of Chicks in the control (Lo) and test group (L1)

Period (Week)	Lots									
	L_0					L_1				
	Q_0	C	CM	GPVM	I.C	Q0	C	CM	GPVM	I.C
00	1302	200	5	-	-	908,8	410	-	-	-
01	1390,02	266	6,7	4,4	0,7	1018	540	13,5	15,0	0,9
02	1602,22	420	12	2,8	4,3	1064,8	608	16	18,8	0,9
03	1622,22	576	18	21,2	0,8	1188,8	828	23	23,0	1,0
04	1702,22	840	28	34,6	0,8	1288	1152	32	18,9	1,7
05	1720,82	896	32	28,6	1,1	1279,4	1444	38	45,8	0,8
06	1720,82	1092	39	17,2	2,3	1296,8	1380	46	36,0	1,3
07	1752,22	1118	43	44,4	1,00	1315,8	1740	58	25,8	0,8
08	1787,22	1350	54	27,6	2,0	1338,8	1850	63	16,7	3,8
Mean	**1622.22**	**837,8**	**29,9**	**23,5**	**1,6**	**1188,8**	**1105,7**	**36,2**	**24,9**	**1,4**

Legend: L_1: Test lot, C: quantity of feed consumed by chick, L_0: Control lot, CM: quantity of average feed consumed by chicks, Q_0: quantity of feed offered to chicks, GPVM: average live weight gain of chicks, R: quantity of feed refused by chicks, IC: consumption index of feed.

This table revealed that the incorporation of C. papaya L. leaves increased Qo, C, CM and GPVM as well as decreases the consumption index.

DISCUSSION

Currently, the competition for food between humans and monogastric animals has become a real concern. The need to identify other non-conventional alternative food sources from local resources is a great challenge. The leaves of *Carica papaya* L. offer for this purpose, the ability to serve as a source of vegetable proteins and secondary metabolites of pharmacological relevance for monogastric animals. The nutritive value of the two diets i.e. control diet and diet enriched with the leaves of *Carica papaya* L. (test diet) show that the calculated nutritive parameters were in respect to the standards with 22.7% and 22.9% of brute proteins, respectively [1, 14]. Compared to the value of brute protein content of banana leaves *(Musa acuminata)* reported by Bouafou *et al.* (17.3%) [16], the present study shows that *C. papaya* L. leaves contain more brute proteins than the banana leaves. The study performed by Dahouda *et al.* [6].on the seeds of *Mucuna* ssp *gavea* give the value of brute protein composition between 22% and 35%. Comparing this result to that of the leaves of *Carica papaya*, we can note that the value of *C. papaya* brute protein is in agreed with the standards normalizes. However, *Mucuna* spp. contain anti-nutrients factors such as L-dopa, HCN, phytic acid, tannins and oxalate [6] thus justifying the key role of *C. papaya* as alternative plant species.

The present study shows that chicks fed with diets enriched with papaya flour (test lot) have acquired a total live weight (4318.80 g) and an average live weight (139.29g) higher than chicks fed with the control with 2959 g and 78.20 g respectively. This greater weight gain observed in chicks fed with the test feed (i.e. feed enriched with *Carica papaya* L. leaves flour) is justified by the fact that these leaves contain papain and enzymes which play an important role in the physiology of domestic animals. In fact, it was reported that papain as well as other proteolytic enzymes, has the ability to dissolve and digest proteins. Such enzymes represent valuable biological resources able to generate molecules with biological and nutritional interests. The presence of papain in the digestive system of the chicks would promote a rapid release of amino acids which are readily absorbed by the cells. These amino acids play an important role in animals' growth [17].

Statistical analysis (according to Student t-test at the probability threshold of 0.05) showed that the difference between these two diets on live weight was significant ($t_{cal.}0.368 > t_{tab}2.306$) (PVM). This indicates that the test diet has influenced more on the body weight than the control one.

Furthermore, this study has also shown that in the lot of chicks having consumed the diet devoid of papaya leaves flour, the mortality was approximately17%, whereas it was only 10% in chicks fed with enriched diets i.e. diet enriched with flour papaya leaves flour. This difference in mortality would be due to the fact that the leaves of *Carica papaya* L. offered to chicks would have played a worming role and vitamin that contains papaya leaves, would have played the protective role in strengthening the immune system of chicks that have benefited of this ingredient in their diet [18].

Our results also show that the chicks of test group (L_1) have been fed weekly with relatively large amount of test diet(1337.5 g) with respect to the chicks in the control group (L_0) (1025g). The reason is that the test diet would contain enzymes that enhance the digestibility of certain proteins of raw materials.

We also notice that the diet enriched with papaya leaves flour had caused few refusals (131.0 g), a high intake (1140.5 g) with an average intake of 36.2 g which has also promoted the weight gain of 24.9 g. While the control diet was little consumed weekly (1025 g) and caused more refusals (180.3 g), low consumption (837.8 g) with an average intake of 29.9 g. This has promoted very low average weight increase weekly (23.5 g) than the test diet. However, the weekly consumption values of these two diets were below 5260 g and 2500 g of live weight at 8 weeks of live broilers as measured by Leclercq *et al.* [13].

Considering the above, it is observed that the test diet was very appetizing and sweetener compared to the control diet because its consumption index was low (1.4) than the control diet (1.6).

In other words, the substances contained in the leaves of papaya improved probably organoleptic quality of the diet.

CONCLUSION

The aim of this study was to evaluate the effects of a diet based on local ingredients on the zootechnical parameters in growing chicks from 0 to 8 weeks.

At the end of this study, the following results have been observed:

- Chicks of test lot (L1) from the due pre-experimental phase have ingested more diets containing papaya leaves flour compared to chicks fed with diets devoid of the aforementioned flour (L0);
- The test diet was more offered and consumed by chicks (13,337.5 g) than the control (1025g);
- The test diet caused less mortality cases than the control diet;
- The supplemented diet is the best because its consumption index is relatively low (1.4) compared to the control diet (1.6);
- The test diet (L1) favored the increase of the average live weight (156.7 g) and the average live weight gain (33.8 g) than the control L0 with respective values of 87.9 and 23.5 g.

These results show that Carica papaya L. could be a good alternative source of proteins to limit the importation of very expensive conventional feeds.

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